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MEMORANDUM

TO:	Warren Dixon USEPA Region IV OSC	cc:	Gary Rogers Neville Kingham Richard McAllister
FROM:	Tim Morrow TM		
DATE:	January 9, 1991		
SUBJECT:	Material Handling "Gumbo" Clay Front End Operations Prairie Metals Project No: 2310-90-1501		

On January 4, 1991, our Gary Rogers (RM) informed me that the EPA was looking for higher technology in the front-end mixing operation of the Portland Cement. I also talked with you that afternoon to discuss the primary goals the EPA was trying to accomplish and was informed of the following:

1. Accurate measurement of the Portland Cement into the "Gumbo" clay. (By weight = 3.4% Portland Cement, see attached.)

2. Continuous operation (if possible).

NOTE: One parameter required to achieve this goal is the weight of soil being introduced into the process be known in order to calculate the amount of Portland Cement required.

After my initial discussions with Gary Rogers I began contacting various companies with varying levels of expertise on the subject of material handling "Gumbo" clay. As of today I have had extensive discussions with a wide range of companies who have actual hands-on and research experience in this area, including the following:

Name	Company
Neville Kingham	Kiber Associates
Tracy Bergquist - General Refining	Kiber Associates
Clay Corman	C.M.C., Inc.
Dan Marks, Ph.D.	WEGS, Inc.

In-House Experience — Westinghouse HAZTECH, Inc.

- G. Rogers
- K. Kinsinger
- D. Carpenter (Construction)
- M. Fox (Construction)
- T. Morrow
  - General Refining
  - Peak Oil (Incineration)
  - LaSalle, IL (Incineration)

Major site restrictions considered during the discussions were as follows:

1. Minimal work area, limited to legal property boundaries
2. Rain during project
3. Cost of Portland Cement (see attached).

The following summarizes the options suggested along with the positives and negatives associated with each option.

Option No. 1: Trackhoe mix to powerscreen to stockpile using bags

Positives:

1. Lab treatability on lagoon sediments verified 3% Portland Cement by weight.
2. Field pilot tests with 2.5% and 5% mix verified the 5% mix processed the best with no reject from the powerscreen (see attached).
3. Personnel and equipment already on site. (No additional costs in mobilization/ demobilization.)
4. Process stockpile to stockpile resulting in minimal exposure of clay soils to rain.
5. Minimal personnel and equipment requirements.

2 operators	1 powerscreen
1 technician	1 conveyor
	1 trackhoe
	1 loader/dozer

6. Requires minimal area for process.
7. Know method works.

Negatives:

1. Not continuous operation.
2. Measurement of the soil and Portland Cement not exact.
3. Bagged cement more expensive than bulk.
4. Productivity 300-400 cu. yd./day.

<u>**Option No. 2**</u>**:** Trackhoe mix in 20 or 30 cu. yd. box utilizing cement silo and a rubber tire loader, with weighing bucket, back to stockpile (see attached drawing).

Positives:

1. Lab treatability on lagoon sediments verified 3% Portland Cement by weight.
2. Field pilot tests with 2.5% and 5% mix verified the 5% mix processed the best with no reject from the powerscreen (see attached).
3. Accurate measurement of soil and Portland cement being mixed.
4. Partial personnel and equipment already on site (same as Option 1). Minimal mobilization/demobilization of additional personnel/equipment.
5. Process stockpile to stockpile resulting in minimal exposure of clay to rain.
6. Requires minimal area for process.
7. Bulk cement less expensive than bagged.

Negatives:

1. Not continuous operation.
2. Productivity 300-400 cu. yd./day.
3. Mobilization/demobilization of additional personnel and equipment.

1 operator	2 30-cu. yd. steel boxes
	1 cement silo
	1 rubber tire loader

4. More work area required than Option No. 1.

NOTE: If the following additional personnel and equipment were used with this option, a continuous process would be achieved (see attached drawing). However, the ARAN would be limited to the productivity of the powerscreens and you will have double the mechanical parts to break down.

1 operator	1 powerscreen
1 technician	1 conveyor
	1 trackhoe

<u>**Option No. 3**</u>**:** Raw material to powerscreen to ARAN (add Portland Cement) to stacking conveyor to stockpile.

Positives:

1. <u>Most</u> accurate continuous measurement of soil and Portland cement available.
2. Field pilot tests with 2.5% and 5% mix verified the 5% mix processed the best with no reject from the powerscreen (see attached).
3. Personnel and equipment already on site. (No additional costs in mobilization/ demobilization.)
4. Process stockpile to stockpile resulting in minimal exposure of clay to rain.
5. Minimal personnel and equipment requirements.

3 operators	1 powerscreen
1 technician	2 conveyors
1 ARAN	1 trackhoe
	1 loader/dozer

6. Requires minimal area for process.
7. Know method works.
8. Bulk cement less expensive than bagged.

Negatives:

1. Not continuous operation.
2. Productivity limited to one powerscreen and conveyor.

<u>**Option No. 4**</u>**:** Powerscreen to second pugmill to powerscreen to ARAN.

Positives:

1. Continuous process.
2. Accurate measurement of the Portland Cement and soil.

Negatives:

1. Additional work area required.
2. Additional personnel and equipment required.

2 operators	1 pugmill or similar
2 technicians	1 powerscreen
	1 conveyor
	1 cement silo

3. ARAN productivity will be limited to the productivity of the second pugmill.
4. Continuous process dependent on additional mechanical parts subject to breakdown.

**5. Low availability of pugmills.

6. Estimated error in the addition of Portland Cement is ± 5%.

NOTE: See Option No. 2 drawing. Add a pugmill and remove the mix boxes.

Option No. 5: Horizontal stockpiling - disc, harrow, (see attached drawing).

1. Bottom Up

Positives:

1. More accurate measurement of soil and Portland Cement being mixed than Option No. 1.
2. Partial equipment already on site. Minimal mobilization/demobilization of additional personnel and equipment.

Negatives:

1. Spread out stockpile.
   - contaminate additional clean soil
   - larger area to protect from rain
2. Mobilization and demobilization and additional personnel and equipment required.

2 operators	1 disc/harrow
	1 dozer

3. Additional work area required.
4. Requires bagged cement which is more expensive than bulk.

2. Top Down

Positives:

1. More accurate measurement of soil and Portland Cement being mixed than Option No. 1.
2. Partial equipment already on site. Minimal mobilization/demobilization of additional personnel and equipment.

Negatives:

1. Spread out stockpile.
   - contaminate additional clean soil
   - larger area to protect from rain
2. Mobilization and demobilization and additional personnel and equipment required.

   2 operators   1 disc/harrow
                  1 dozer

3. Additional work area required.
4. Requires bagged cement which is more expensive than bulk.
5. Hard to control excavation from top down due to raw material containing debris.

Other options discussed but determined unfeasible were:

1. Volatilizers - High cost
   - chemical changes to soil could affect treatability
   - air emissions
2. Disintegrator - High cost
   - low productivity

In Summary:

__Option No. 1__: Trackhoe mix to powerscreen to stockpile using bags

__Option No. 2__: Trackhoe mix in 20 or 30 cu. yd. box utilizing cement silo and a rubber tire loader, with weighing bucket, back to stockpile (see attached drawing).

__Option No. 3__: Raw material to powerscreen to ARAN (add Portland Cement) to stacking conveyor to stockpile.

Option No. 4: Powerscreen to second pugmill to powerscreen to ARAN.

Option No. 5: Horizontal stockpiling - disc, harrow, (see attached drawing).

Taking the site restrictions into consideration, in order to meet the EPA goal of accurate metering of the Portland cement, I recommend the following options in order:

1. Option No. 3
2. Option No. 2

Due to the high cost and low availability of another pugmill or similar blending machine, to meet the EPA goal of continuous operation and avoid a two-stage process, I recommend the following options in order:

1. Option No. 2
2. Option No. 1

From a total project perspective, Option No. 2, is the overall best solution.

1. Eliminates mobilization/demobilization of large amount of additional equipment which can only be utilized for the mixing process.
2. Rain delays.
3. Minimize the amount of mechanical parts in the process (reduces downtime due to equipment failure).
4. Accurate measurement.
5. Overall cost effectiveness.
6. The consistency of the feed soil can be monitored constantly and increases or decreases in the amount of Portland Cement can be accomplished.

PORTLAND CEMENT COSTS

The field pilot tests performed at the site assumed the following:

1 cu. yd. = 1 ton

96 lb. of Portland cement was added to one cubic yard of soil

96 lb. ÷ 2,000 lb. = .048 or 4.8%.

A more accurate estimate of the weight of the raw soil required utilizing a density factor of 1.40 for this material.

2,000 lb. x 1.40 = 2,800 lb./cu. yd.
96 lb. ÷ 2,800 = .034 or 3.4%

If 5,000 cubic yards will be processed, the following amount of Portland cement will be required (no error factor):

5,000 cu. yd. x 1.40 = 7,000 TN.
7,000 TN x .034 = 238 TN

The cost for this amount of Portland cement in bags would be:

238 TN. ÷ 96 lb. = 4,958 bags
4,958 bags x $4.80 = $23,798
$23,798 x 1.085 G&A = $25,821

The cost for this amount of Portland cement in bulk would be:

238 TN x $70 = $16,660
$16,660 x 1.085 G&A = $18,076.

To summarize, the cost for Portland cement, on the front end, to process 5,000 cu. yd. of this material is:

$18,076 Delivered in bulk
$25,821 Delivered in bag

OPTION NO. 2 - "CONTINUOUS OPERATION"

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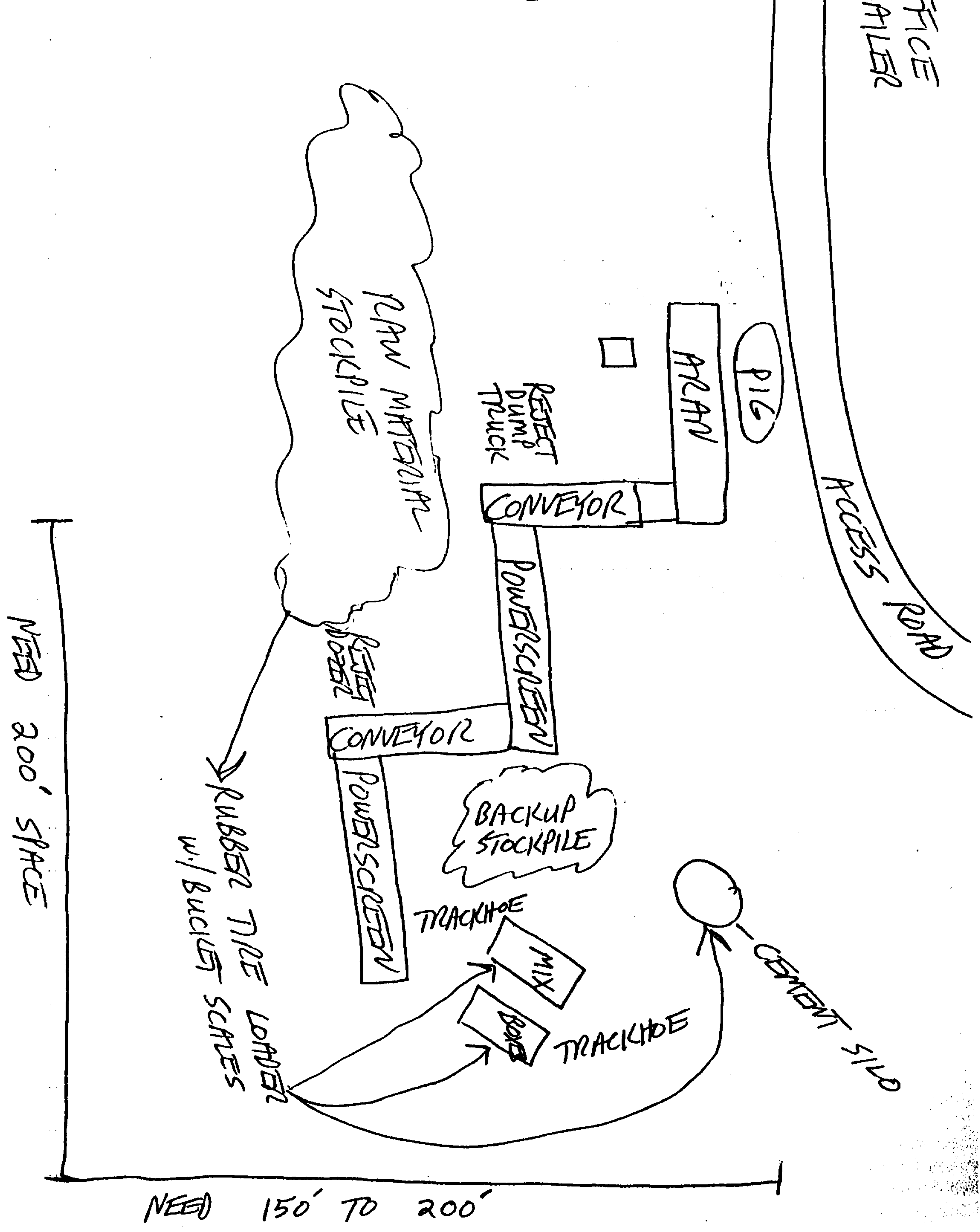
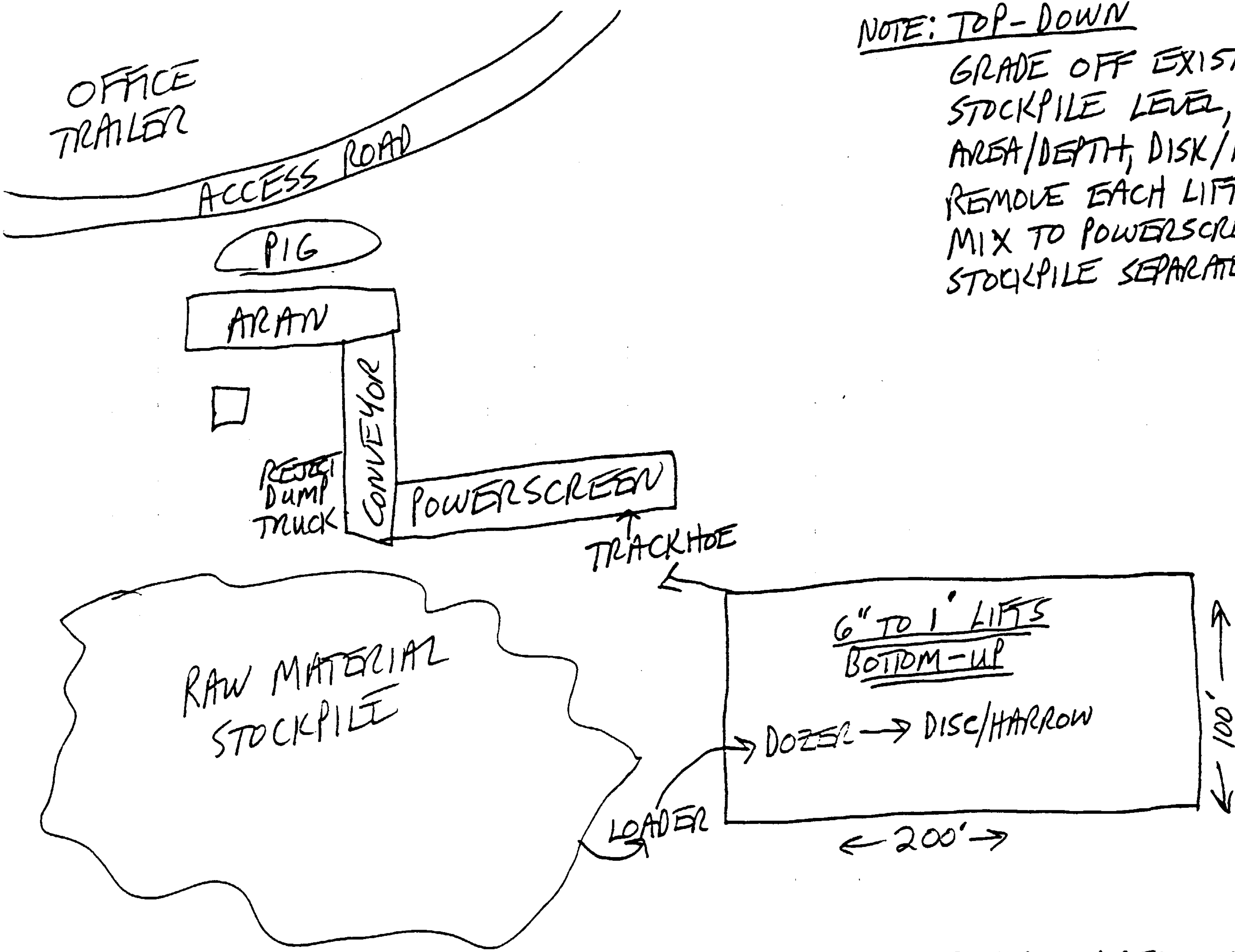


OPTION NO. 5 "BOTTOM-UP"

NOTE: TOP-DOWN

GRADE OFF EXISTING STOCKPILE LEVEL, CALCULATE AREA/DEPTH, DISK/HARROW, REMOVE EACH LIFT AFTER MIX TO POWERSCREEN OR STOCKPILE SEPARATELY, REPEAT

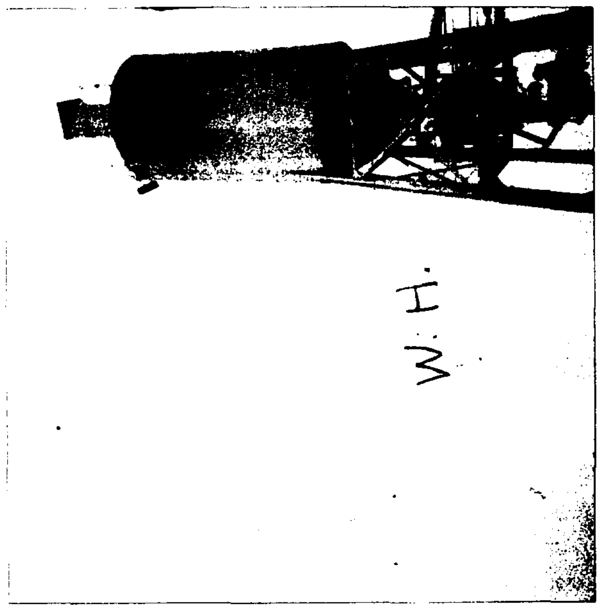


MEASURE EXACT AREA AND DEPTH

1' = 1,037 TN SOIL X .034 = 35.25 TN. PORTLAND CEMENT

WEIGH HOPPER

WEIGH HOPPER



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